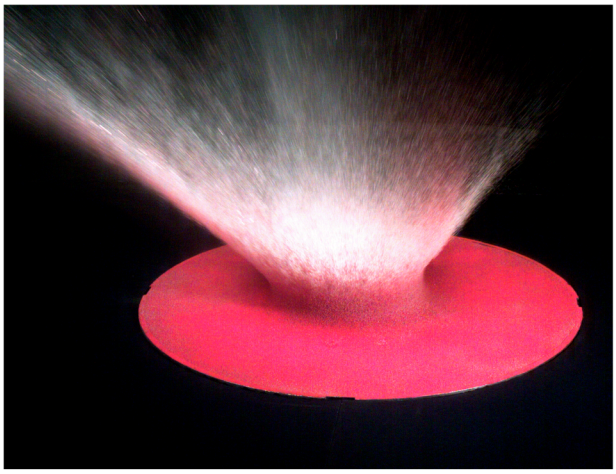
Ames Vertical Gun Range (AVGR)

Code: TSF Thermophysics Facilities Branch, Entry Systems & Technology Division

Providing a unique, ground-based, celestial body impact simulation capability in support of the Nation's Research and Development activities in the realm of high-speed impact physics.

Overview

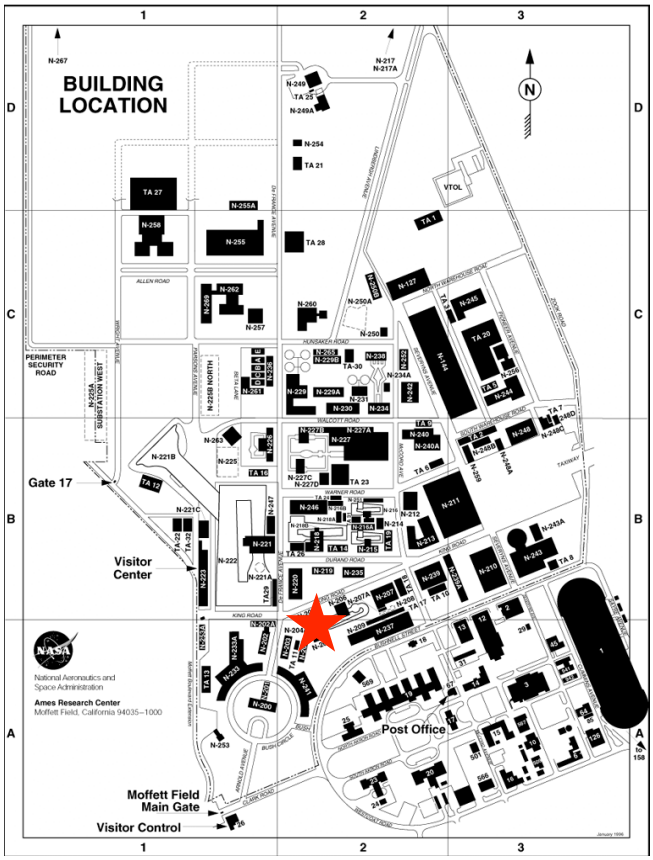
The Ames Vertical Gun Range (AVGR) is a unique NASA facility that is typically used to simulate high-speed, celestial body impacts on a small scale. Data obtained from such studies can be used to establish a clearer understanding of the physics and phenomena associated with crater formation processes; projectile (impactor) failure modes and mechanisms; and, debris dispersion and characterization. The AVGR first began operations in 1966 in support of the Apollo program as a means to better understand lunar surface geomorphology. More than four decades later, this modest (6000 ft^2) facility continues to provide invaluable data for NASA's Planetary Geology and Geophysics program. During its illustrious history, the AVGR has supported NASA's Exobiology and Solar System Origins programs, and provided critical enabling data for such missions as Cassini, Stardust, Mars Odyssey, Mars Exploration Rovers (MER), Deep Impact and Lunar Crater Observation and Sensing Satellite (LCROSS).



Typical Hypervelocity Impact

Location

The AVGR is located in building N204A at Ames Research Center (see map).



Capabilities

The AVGR utilizes a family of model-launching guns to accelerate particles of various size, shape and material composition to velocities approaching 7 km/sec. The angle of elevation of the gun with respect to the horizontal plane can be varied in 15° increments from 0° to 90°, thus permitting oblique angles of impact with respect to the gravitational vector.

A large impact chamber, which can accommodate sizable targets of varying composition (solid, liquid, aggregate, etc.), allows for testing at sub-atmospheric pressures and in gases other than air. Primary instrumentation consists of a diverse suite of state-of-the-art, high-speed imaging systems that can record the impact event and cratering processes with tremendous detail. In addition, spectroscopy, Particle Induced Velocimetry (PIV), and other forms of instrumentation can be accommodated through special arrangement.

Equipment:

Performance Summary-

- Projectile speed 0.5 to 7.0 km/sec
- Projectile size[1] 0.005 mm to 7.6 mm
- Projectile geometry sphere, cylinder, irregular shapes
- Projectile composition metallic, plastic, glass, mineral

[1] Individual particles: 1.5 to 7.6mm; group of three 0.2 to 1.0mm; and cluster of many 0.005 to 0.2mm.)

Impact Chamber Specifics-

- Environment variable (Air, CO2, etc.)
- Pressure 0.04 to 760 torr
- Temperature Ambient
- Diameter 2.5 m
- Height2.5 m
- Volume 14 m^3

High-Speed Imaging System-

Equipment includes: a pair of Vision Research, Phantom V10 cameras; a pair of Phantom V12 cameras; and a pair of Shimadzu HPV-1 cameras. Both Phantom camera types are color, can be operated over a wide range of framing rates, exposure times, resolution levels, variable aspect ratios (image sizes), and extensive record lengths (i.e. over 1 second at maximum frame rate and resolution). The V10 units are 14 bit devices and are particularly well suited for, yet not limited to, framing rates up to 10,000 fps. Likewise the V12 units are 12 bit devices and are well suited for framing rates ranging from 10,000 to 50,000 fps (yet they can go as high as 1,000,000 fps). The Shimadzu cameras are 10 bit devices, monochromatic, and maintain an image size of 312 x 260 pixels and a record length of 102 frames for all framing rates (up to 1,000,000 fps). Data files from all of the camera systems are delivered in either .avi or stacked .tiff format.

Staff:

The AVGR operating crew consists of four people: a Facility Manager; two Facility Technicians; and one Imaging Technologist. In addition, the branch and center provide engineering and machine shop support resp.

Recent Customers/Users:

Planetary Geology and Geophysics Program-PGGP (NASA SMD), Stardust, Mars Scout (JPL), Deep Impact, Lunar Environments (MSFC), Lunar Crater Observation and Sensing Satellite-LCROSS.

POC

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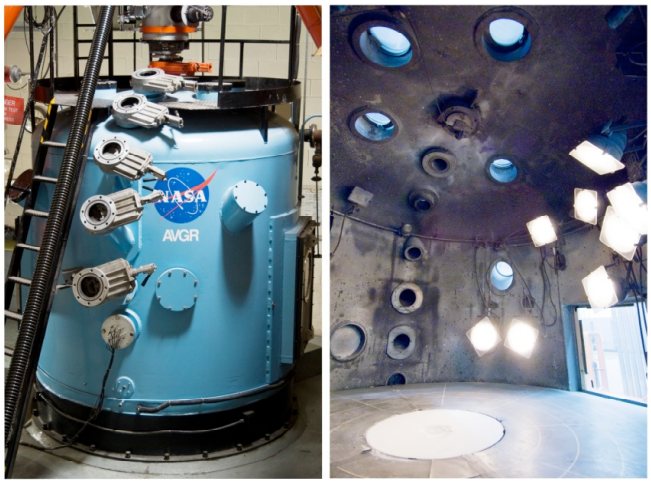
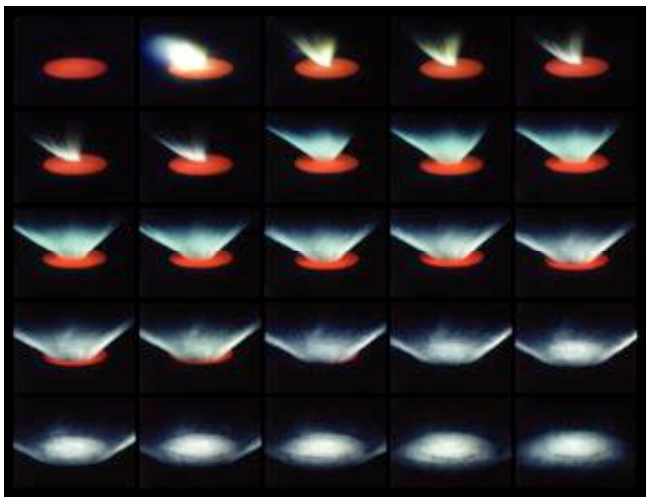
AVGR (vertical orientation)



Impact Chamber (exterior and interior views)



Typical ejecta dispersion and capture analysis data